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Julian Lin
National University of Singapore

Hock Chan
National University of Singapore

Yang Jin
National University of Singapore

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Julian LIN
Department of Information Systems
National University of Singapore
jlin@comp.nus.edu.sg

Hock Chuan CHAN
Department of Information Systems
National University of Singapore
chanhc@comp.nus.edu.sg

Yang JIN
Department of Information Systems
National University of Singapore
yang.jin@nus.edu.sg

Abstract

The Unified Theory of Acceptance and Use of Technology (UTAUT) model is used to study acceptance and usage of instant messaging among college students. This study validates the UTAUT model in a new environment which is not work related. The results show that functional capability (the presence of various functions in the application) has a direct effect on behavior intention as well as on performance and effort expectancies. The results also show that performance expectancy does not have the hypothesized effect on behavioral intention. This may be attributed to the non-work environment. As replacement, attitude becomes a significant factor on behavioral intention. Peer influence is also found to be an important factor. The model explains more than 60% of the variance in behavioral intention. With the identification of new important variables and relationships for instant messaging, companies of such products can adjust their focus accordingly.

Keywords: Functional capability, Unified theory of acceptance and use of technology (UTAUT), User acceptance, Peer influence, Social influence

Introduction

In Information Systems (IS) research, there have been many user acceptance models. A recent development and refinement of technology acceptance model by Venkatesh et al. (2003) is a major step in IS user acceptance research as they examine eight major user acceptance models, and integrate them into a model named Unified Theory of Acceptance and Use of Technology (UTAUT). As UTAUT is a new model, examining this model in different settings such as different technologies and different user groups is necessary. Because the first empirical study in UTAUT was in a formal environment (a work context), this paper tries not only to validate UTAUT in a more informal setting (campus), with a more informal application (instant messaging), and with young adults as subjects, but also attempts to examine the antecedents of UTAUT.

Additionally, since instant messaging (IM) is a popular application among youngsters (Grinter and Palen 2002, Huang and Yen 2003, Nardi et al. 2000, Rennecker and Godwin 2003, Mock 2001), this paper separates social influence into two different constructs, peer influence and social influence. It is believed that peer influence is a very important factor toward many aspects of lives in youngsters (Brittain 1963; Berndt 1979; Savin-Williams and Berndt 1990; Sim and Koh 2003; Santor et al. 2004). For instance, a study finds that young people are twenty four times more likely to become a smoker if they have about three friends who are smokers (Lloyd-Richardson et al. 2002). Previous research in user acceptance (i.e. TAM) has also differentiated the concept of peer and social influence (Taylor and Todd, 1995). Therefore, this paper also tries to examine the possibility that peer influence is also an important factor for use of an instant message application by young people.

As modern technologies include more functions into a single application (e.g. instant messaging includes functions such as history-keeping, ability to appear offline (invisible), notification using pop-up window or knocking sound, buddy list and others), functional capabilities within the application could have important effects on the intention to use the software.

The next part presents the background information about instant messaging, UTAUT, peer influence, and functional capability. This is followed by the research model and methodology, and subsequently is followed by the findings, discussion and conclusion.

Background

Instant Messaging

The most cited definition for instant messaging in the literature (Rennecker and Godwin 2003, de de Vos et al. 2004, Isaacs et al. 2002a, 2002b, Grinter and Palen 2002) is by Nardi et al. (2000). They define instant messaging as "a tool which allows for near-synchronous computer-based one-on-one communication". Currently, the major players of IM include MSN messenger, ICQ, Yahoo messenger, and AOL (aiming), and these IM applications include functions such as history-keeping, real-time video and audio chatting, sending offline messages, allowing users to check emails, appear offline (invisible), notification (pop-up window or knocking sound), buddy list and others (Huang and Yen 2003, Rennecker and Godwin 2003, Grinter and Palen 2002, Mock 2001). The users of instant messaging, which is also called IM or IMing (aiming), is growing rapidly (Swatz 2003).

Recent research in IM focuses on the suitability of IM for the work context. On one side, researchers doubt the contribution of IM in the workplace. For instance, Renneker and Godwin (2003) point out that IM could decrease the productivity of workers because it increases communicative workloads as well as frequency of interruption. Additionally, researchers also indicate that IM poses a security threat to the enterprise (Saunders 2003, Swartz 2003). On the other side, some researchers also show that IM contributes toward corporate communication (de Vos et al. 2004, Nardi et al. 2000, Isaacs et al. 2002a, 2002b, 2002c, Swartz 2003, Saunders 2003). Although there are many studies that examined the adoption of IM in the workplace, studies which looked at how young users adopt the technology in more informal environment are few. A few exceptions are studies by Huang and Yen (2003) and Grinter and Palen (2002). Each of these studies looks at how useful IM is to young users (Huang and Yen 2003), and describe qualitatively how teenagers use the technology (Grinter and Palen 2002). More work that specifically looks at the intention to use the technology among young users may be necessary since IM is very popular for those users (Grinter and Palen 2002, Huang and Yen 2003, Nardi et al. 2000, Rennecker and Godwin 2003, Mock 2001).

Unified Theory of Acceptance and Use of Technology (UTAUT)

There are many competing models for user acceptance research, among them are the theory of reasoned action (TRA) (Ajzen and Fishbein 1980; Fishbein and Ajzen 1975), the technology acceptance model (TAM) (e.g. Davis 1989, Davis et al. 1989), the diffusion of innovation (DOI) (Rogers 1995), the social cognitive theory (SCT) (Compeau and Higgins 1995, Compeau et al. 1999), the theory of planned behavior (TPB) (Ajzen 1991), and the motivational model (Davis et al. 1992). A recent integration by Venkatesh et al. (2003) is an important milestone in user acceptance research as it examines these major user acceptance models, and comes out with a unified model named Unified Theory of Acceptance and Use of Technology (UTAUT).

UTAUT consists of four constructs directly influencing intention and usage. These are performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy is "the degree to which an individual believes that using the system will help him or her to attain gains in job performance". Effort expectancy is defined as "the degree of ease associated with the use of the system," and social influence is "the degree to which an individual perceived that important others believe he or she should use the new system". And lastly, facilitating conditions refers to "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system".

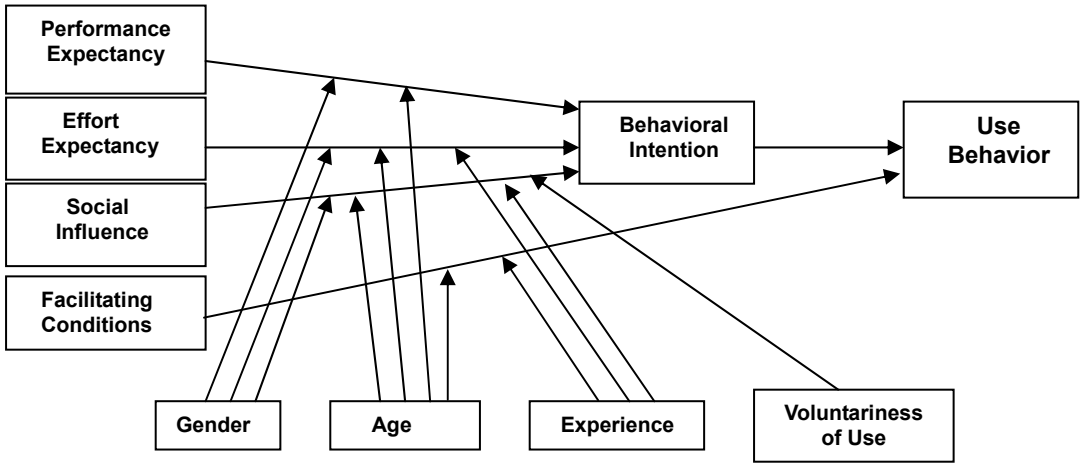

Figure 1. Unified Theory of Acceptance and Use of Technology (Venkatesh et al. 2003)

Additionally, four constructs (gender, age, experience and voluntariness) are hypothesized to moderate the relationship between behavioral intention or usage and their antecedents (i.e. performance expectancy, effort expectancy, social influence and facilitating conditions). Specifically, the effect of performance expectancy on intention is moderated by gender and age, the effect of effort expectancy on intention is moderated by gender, age and experience, and the effect of social influence on intention is moderated by gender, age, experience and voluntariness of use. Lastly, the effect of facilitating conditions on usage is moderated by age and experience (see figure 1 for detail).

In the model, there are also three constructs which are not hypothesized to have direct influences on intention. These constructs are computer self-efficacy, computer anxiety, and attitude toward using technology (Venkatesh et al. 2003).

Functional Capability

Technology Acceptance Model (TAM), one of the models integrated into UTAUT, has been validated across different settings. TAM has main 3 factors: perceived ease of use (PEOU) (similar to effort expectancy), perceived usefulness (PU) (similar to performance expectancy) and behavioral intention (BI). Many studies in TAM examine the effects of external variables on PU or PEOU, or even on BI (Igrabria et al. 1995, Gefen and Straub 1997, Igrabria et al. 1997, Venkatesh 2000, Hong et al. 2001). One of the most investigated external variables is system characteristics (David et al. 1989, Davis 1993, Igrabria et al. 1995, Hong et al. 2001, Venkatesh 1999, Venkatesh 2000). In fact, system characteristics have been a predictor of the intention to use even before TAM exists (Lucas 1978, Benbasat et al. 1986, Benbasat and Dexter 1986). Existing research operationalizes system characteristics with general system features such as the quality of input, the quality of output, the quality of user interface, screen

design, as well as the relevance of the system (Lucas 1978, Benbasat et al. 1986, Benbasat and Dexter 1986; Igrabria et al. 1995, Hong et al. 2001, Venkatesh 1999, Venkatesh 2000).

With modern technologies merging and integrating many different functions into a single system, system characteristics could be measured directly by the functional capabilities which are included in the application. In the past, this approach was not so relevant due to the limited functions within the application. For instance, an email system was mainly designed with the functions for only sending and receiving email. Nowadays, more functions such calendar scheduling, and workflow are included in the system. Consequently, the measurement of system characteristics using functional capabilities as the predictor of PEOU, PU or BI will be more important.

Peer Influence

Adolescents spend their time twice as much with peers as with parents (Csikszentmihalyi and Larson 1974). Their relationships with peers are more salient during this time (Savin-Williams and Berndt 1990). Therefore, they are also more vulnerable to peer pressure than little children or adults (Brehm and Kassin 1995, pp. 340). Since this paper examines the usage of IM among young adults in college, the influence of peers on intention and usage of the technology may also be salient.

In this paper, peer influence is differentiated from social influence. While peer influence specifically refers to friends as the referent groups, social influence, in general, refers to other referent groups besides friends. In fact, studies in TAM have broken up social influence into at least two constructs such as peer influence and superior influence (e.g. Taylor and Todd 1995).

Research Model and Methodology

Figure 2 shows the research model for this study. Age is taken off from this study because the subjects are mostly of the same age group. Similarly, voluntariness of use is excluded since usage of IM for students is highly voluntary. Consistent with the prior study by Venkatesh et al. (2003), the expected relationships among performance expectancy, effort expectancy, gender, experience and intention are listed as follow:

For direct effects, the expected relationships are:
H1a: Performance expectancy will have an effect on behavioral intention
H1b: Effort expectancy will have an effect on behavioral intention
H1c: Facilitating conditions will **not** have a significant influence on behavioral intention.
H1d: Behavioral intention will have a significant positive influence on usage.

For moderating effects, the expected relationships are:
H2a: The effect of performance expectancy on behavioral intention will be moderated by gender, such that the effect will be stronger for men
H2b: The effect of effort expectancy on behavioral intention will be moderated by gender and experience such that the effect will be stronger for women with less experience. .
H2c: The effect of facilitating conditions on usage will be moderated by experience, such that the effect will be stronger for people with more experience.

For constructs theorized **not** to be direct determinants of intention, the hypotheses are:
H3a: Self-efficacy will **not** have a significant effect on behavioral intention.
H3b: Computer anxiety will **not** have a significant effect on behavioral intention.

H3c: Attitude toward using technology will **not** have a significant effect on behavioral intention.

Besides measuring and validating the UTAUT constructs, this paper also examines some additional external variables to UTAUT. Specifically, this paper looks at whether functional capability (i.e. system characteristics) could predict performance expectancy, effort expectancy, and behavior intention. These hypotheses are consistent with the prior research (e.g. Igrabria et al. 1995) where system characteristics are hypothesized as the predictor of perceived ease of use (similar to effort expectancy), perceived usefulness (similar to performance expectancy), and behavior intention. Therefore, this paper hypothesizes:
H4a: Functional capability will have an effect on performance expectancy
H4b: Functional capability will have an effect on effort expectancy
H4c: Functional capability will have an effect on behavior intention

Additionally, peer influence is expected to have a main effect on the acceptance of IM application among young adults in the college. This is consistent with the finding in the prior research (Taylor and Todd, 1995) where the effect of peer influence is stronger than superior influence when they use students as the subjects.
H5a: Peer pressure will have an effect on behavioral intention

Furthermore, previous research also shows that conformity with peers is stronger than with parents in many aspects of young adults' lives (Brittain 1963, Sim and Koh 2003). Thus, peer influence will be the main effect on behavioral intention to use IM for young adults. Recent studies also found interaction effects between peer and social influence. For example, Liu (2003) shows that a person with actual or perceived responses from significant others in curbing inappropriate behavior (i.e. informal sanction threat in their terminology) is more likely to resist deviant peer influence. Simons-Morton (2004) also shows that peer influence not only is positively associated with drinking initiation, but parental influence (refers to how upset if they parents found out they drink) also reduces the effect of peer influence on drinking initiation. Thus, social influence is expected to moderate the relationship between peer influence and behavioral intention. Thus, we hypothesize
H5b: The effect of peer influence on behavioral intention will be moderated by social influence, such that higher social influence will reduce the effect of peer influence.

Subject
The subjects are undergraduate students in Singapore, and most of them are teenagers and young adults in their early twenties. They have knowledge of at least two IM software, such as ICQ and MSN.

Construct Measurement
Subjects are asked for their perceptions and intended behavior of using ICQ, an IM application. ICQ is selected because it is one of the earliest ISP-independent IM applications. It has also received many recognitions, such as the "best internet program" by CNET, "essential download" by PC Magazine, "the top downloads and editors picks" by Softseek and others (ICQ.com 2004). Most instruments are adapted from previous research (Venkatesh et al. 2003). Some items are dropped or modified to fit the context of the research. At the end, performance expectancy consists of 3 items, effort expectancy has 4 items, attitude has 4 items, social influence has 2 items, facilitating conditions has 3 items, self-efficacy has 4 items, anxiety has 3 items, behavioral intention has 3 items, peer influence has 3 items, and

functional capability has 10 items (Appendix A lists all the items). All items are rated using a seven-point Likert scales ranging from strongly disagree (1) to strongly agree (7).

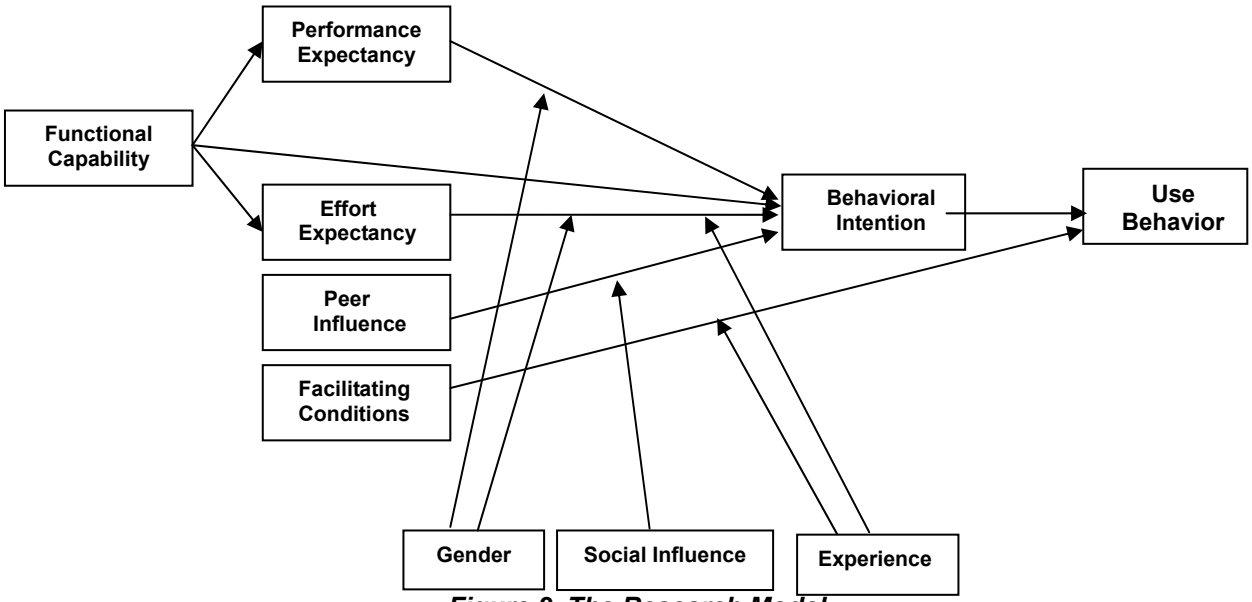

Figure 2. The Research Model

Instrument Administration

Surveys are administered to students from eight different faculties during a one-week period. They fill the questionnaires after lectures or tutorial classes, and they are compensated S$10 for their participation. All students complete all items within 10 to 15 minutes. Finally, a total of 300 responses are usable.

Data Analysis

The research model described in figure 2 is analyzed using Partial Least Squares (PLS). PLS is a second generation multivariate technique which could assess the measurement model (i.e. reliability coefficients, factor analysis) and structural model (i.e. path coefficients, and R2) simultaneously in one operation. Additionally, PLS is suitable for a small set of sample size and is not sensitive to normal distribution (Chin et al. 1998, Gefen et al. 2000). The program used in this analysis is PLSGraph, together with SPSS. For testing path coefficients, t-value is assessed with a nonparametric test of significance known as bootstrapping (Chin et al. 1998, Hair et al. 1998).

Result

Table 1 reports the sample characteristics. The average age of the participants is 21.8. There are slightly more female participants in the survey (51.3%).

Measurement Model

All constructs, except functional capability, are reflective indicators. Two items on self-efficacy, an item on facilitating condition and an item on anxiety have loadings lower than .70, and they are dropped from the model, and the model is re-estimated (see Appendix A for all deleted items). In PLS, composite reliability (ρ_C) is the measurement for internal consistency. All constructs show high composite reliability ranging from 0.84 to 0.98. These numbers are higher than the acceptable 0.70 threshold for field research (Nunnally and Bernstein 1994). For detail, please see the row "Reliability" in table B1 (Appendix B).

Table 1. Sample Characteristics (N=300)			
Gender	Male (M)	N=149	49.7%
	Female (F)	N=151	51.3%
School	Computing	N=100 (M:63 F:37)	33.3%
	Engineering	N= 52 (M:40 F:12)	17.3%
	Arts and Social Science	N= 52 (M:12 F:40)	17.3%
	Business	N= 41 (M:15 F:26)	13.6%
	Law	N= 33 (M:11 F:22)	11.0%
	Architecture	N= 7 (M:1 F:6)	2.3%
	Science	N= 15 (M:7 F:8)	5.0%
Age	**Mean**=21.79;**SD**= 1.56;**Mode**=21;**Median**=22;**Range**=Min=18,Max=29		

Table B1 and table B2 (in Appendix B) present discriminant validity of the constructs. Table B1 shows that item loadings on their own constructs are higher than on other constructs. Additionally, table B2 shows the average variance extracted (AVE), in which all constructs share more variance with their indicators than other constructs. Therefore, the results confirm that the constructs have adequate convergent and discriminant validity.

Structural Model

The results are fairly consistent with Venkatesh et al. (2003). For instance, self-efficacy, and anxiety do not have any effects on intention. Nevertheless, attitude shows a direct effect on intention (β=0.17, t-value=2.79, $p < 0.01$). To be consistent with previous research all three constructs are dropped from further examination (Venkatesh et al. 2003). The result of the multivariate test of structural model is presented in table 2. Table 2a and 2b show the result where functional capability is the independent variable to performance and effort expectancy respectively. Table 2c and 2d present the result where intention and use are the dependent variables. Table 2 also presents R^2 from PLS, R^2 as well as Adjusted R^2 from hierarchical regression, the path coefficients, t-statistics, as well as direct and interaction effects. The results are summarized in table 3.

Discussion and Conclusion

Many hypotheses are supported, and the R squares are relatively high (e.g., 0.6 for BI), thus showing that the modified UTAUT model can be used to study the acceptance and use of instant messaging among students. Functional capability is shown to have significant direct effects on the factors of performance expectancy, effort expectancy and behavioral intention.

Several hypotheses in this study are not supported by the data. The differences may be attributed to the different environment studied in this survey. The study by Venkatesh et al. (2003) is in the work environment, whereas this study in on individual communication in a non-work environment. For instance, PE (H1a, H2a) was found to have a strong effect in the work environment (Venkatesh et al. 2003), but in this study, PE has no effect on BI. A likely explanation for the difference is that the PE construct is perhaps more suitable for a work context. PE is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al 2003). Using IM does not help one to gain any job performances such as higher grades for college students. In fact, IM is used mostly to increase socializing opportunities with peers (Grinter and Palen 2002). Even IM researchers who claim that IM is useful in a work context also confirm that IM is only suitable for the purposes such as quick questions, or coordinating impromptu work-related tasks (de Vos et al. 2004, Isaacs et al. 2002a, 2002b, Grinter and Palen 2002).

Table 2. Multivariate Test of Structural Model				
(a) Dependent Variable: Performance Expectancy				
	D	**t-value**	**D+I**	**t-value**
R^2 (PLS)	0.132		No interaction	
Functional Capability (Function)	***0.36	7.67	***0.36	7.13
(b) Dependent Variable: Effort Expectancy				
	D	**t-value**	**D+I**	**t-value**
R^2 (PLS)	0.260		No interaction	
Functional Capability (Function)	***0.51	8.74	***0.51	8.72
(c) Dependent Variable: Intention				
	D	**t-value**	**D+I**	**t-value**
R^2 (PLS)	0.624		0.641	
R^2 (hierarchical regrn)	0.624		0.641	
Adjusted R^2 (hierar regrn)	0.615		0.626	
Performance Expectancy (PE)	0.06	1.25	0.04	0.92
Effort Expectancy (EE)	*0.11	2.02	-0.48	-0.20
Facilitating Condition (FC)	0.01	0.01	0.00	0.08
Peer Influence (PEER)	***0.46	7.45	***0.40	6.36
Social Influence (SI)	-0.07	-1.61	*-0.10	-2.31
Function Capability (Function)	*0.16	2.34	*0.13	2.12
Gender (GDR)	-0.06	-1.42	0.07	1.63
Experience (EXP)	*0.13	2.39	**0.14	2.68
EE x EXP			0.48	0.25
EE x GDR			0.004	0.01
PE x GDR			0.002	0.04
PEER x SI			***-0.15	-3.46
EE x GDR x EXP			0.974	0.24
(d) Dependent Variable: Use				
	D	**t-value**	**D+I**	**t-value**
R^2 (PLS)	0.563		0.567	
R^2 (hierarchical regrn)	0.563		0.567	
Adjusted R^2 (hierar regrn)	0.559		0.561	
Behavioral Intention (BI)	***0.48	10.83	***0.49	9.52
Experience (EXP)	***0.34	6.68	***0.34	6.10
Facilitating Condition (FC)	-0.04	-0.95	-0.08	-1.22
EXP x FC			-0.07	-1.50

**** P < 0.05***
***** P < 0.01***
****** P < 0.001***

Notes:
D=Direct effects; D+I =direct effects and interaction effects
Gray cells are not applicable.

Table 3. Summary of Results		
H1a	Performance expectancy will have an effect on behavioral intention	Not supported
H1b	Effort expectancy will have an effect on behavioral intention	Supported
H1c	Facilitating conditions will **not** have a significant influence on behavioral intention.	Supported
H1d	Behavioral intention will have a significant positive influence on usage.	Supported
H2a	The effect of performance expectancy on behavioral intention will be moderated by gender, such that the effect will be stronger for men	Not Supported
H2b	The effect of effort expectancy on behavioral intention will be moderated by gender and experience such that the effect will be stronger for women with	Not Supported

	less experience.	
H2c	The effect of facilitating conditions on usage will be moderated by experience, such that the effect will be stronger for people with more experience.	Not Supported
H3a	Self efficacy will **not** have a significant effect on behavioral intention.	Supported
H3b	Computer anxiety will **not** have a significant effect on behavioral intention.	Supported
H3c	Attitude toward using technology will **not** have a significant effect on behavioral intention.	Not Supported
H4a	Functional capability will have an effect on performance expectancy	Supported
H4b	Functional capability will have an effect on effort expectancy	Supported
H4c	Functional capability will have an effect on behavior intention	Supported
H5a	Peer pressure will have effect on behavioral intention	Supported
H5b	The effect of peer influence on behavioral intention will be moderated by social influence, such that higher social influence will reduce the effect of peer influence.	Supported

The lack of support for H2b, and H2c is consistent with previous research (Venkatesh et al. 2003 pp. 466). In particular, gender shows no moderating effects on the relationships. Attitude, in the presence of other factors in the UTAUT model, was found to have no significant effect in the study by Venkatesh et al. (2003). However, our results show that attitude does have affect on intention. In their analysis of various models (including TAM, TPB, TRA and motivation model), Venkatesh et al. (2003) concluded that attitude is only significant when constructs such as performance and effort expectancies do not exist. This is partially consistent with our results. In this survey, PE exists but is not significant.

Before highlighting the implications for research and practice, this section lists the limitations. First, the measurement for usage is self-reported. Previous research shows differences between self-reported usage and actual usage (Szajna 1996, Legris et al. 2003). Particularly, Legris et al. (2003) show that self-reported usage may not be accurate. Therefore, future research should try its best to measure actual usage. Second, recent IS acceptance researchers are concerned with the appropriateness of using TAM to measure intention after initial exposure. For instance, some researchers propose models such as IS continuance (Bhattacherjee 2001, Bhattacherjee and Premkumar 2004, Limayem et al. 2003). On the other hand, high variance in intention can be explained with this model, providing some support for the appropriateness of using UTAUT for measuring intention after initial adoption. This research also has implications for research and practice. For research, this study highlights the different results that may be found in work and non-work environments. In particular, performance expectancy may be less important in non-work environments, where attitude may become a more significant factor. It also found that functional capability is an important predictor. Indeed, our results show that functional capability has a stronger effect than PE or EE on intention. This study also shows the applicability of using the modified UTAUT model to analyze non-work environments. The approach could be used by developers who build application for non-work purposes such as game, instant messaging, music sharing, fans website, and others. In practice, it will be important for IM software developers to improve and integrate new functionalities for their products. Furthermore, companies of IM products, or non-work related products in general, should not neglect the attitude factor.

REFERENCES:

Ajzen, I., and Fishbein, M., *Understanding Attitudes and Predicting Social Behavior*, Prentice-Hall, Englewood Cliffs, NJ, 1980

Ajzen, I., "The Theory of Planned Behavior", *Organizational Behavior and Human Decision Processes*, 50, pp. 179-211, 1991.

Benbasat, I., and Dexter, A. S. "An Experimental Investigation of the Effectiveness of Graphical and Color Enhanced Information Presentation under varying Time Constraints," *MIS Quarterly* (10:1), 1986, pp.59-84

Benbasat, I., Dexter, A. S., and Todd, P. "An Experimental Program Investigating Color-Enhanced and Graphical Information Presentation: An Integration of the Findings," *Communication of ACM* (29), 1986, pp.1094-1105

Berndt, T. J. "Development Changes in Conformity to Peers and Parents," *Developmental Psychology* (15), pp. 608-616

Bhattacherjee, A. "Understanding Information Systems Continuance: An Expectation-Confirmation Model," *MIS Quarterly* (25:3), 2001, pp.351-370.

Bhattacherjee, A., and Premkumar, G. "Understanding Changes in Belief and Attitude toward Information Technology Usage: A Theoretical Model and Longitudinal Test," *MIS Quarterly* (28:2), 2004, pp.229-254

Brehm, S. S., and Kassin, S. M. *Social Psychology* (3rd ed.), 1995, Houghton Mifflin Company, pp. 340

Brittain, C. V. "Adolescent Choices and Parent-Peer Cross-Pressures," *American Sociological Review* (28), pp. 385-391

Chin, W. "The Partial Least Squares Approach to Structural Equation Modeling," In G. A. Marcoulides (ed.), *Modern Methods for Business Research*, Lawrence Erlbaum Associates, Mahwah, NJ, 1998. pp. 295-336.

Compeau, D.R., and Higgins, C.A. "Computer Self-Efficacy: Development of a Measure and Initial Test," *MIS Quarterly* (9:2), 1995, pp.189-211

Compeau, D.R., Higgins, C.A., and Huff, S. "Social Cognitive Theory and Individual Reactions to Computing Technology," *MIS Quarterly* (23:2), 1999, pp.145-158

Csikszentmihalyi, M. and Larson, R. *Being Adolescent: Conflict and Growth in the Teenage Years,* New York: Basic Books, 1984

Davis, F. D. "Perceived Usefulness, Perceived Ease of Use and User Acceptance of Information Technology," *MIS Quarterly* (13:3), 1989, pp. 319-339.

Davis, F. D., "User Acceptance of Information Technology: System Characteristics, User Perceptions, and Behavioral Impacts," *International Journal of Man – Machine Studies* (38), 1993, pp. 475-487.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "Extrinsic and Intrinsic Motivation to Use Computers in the Workplace," *Journal of Applied Social Psychology* (22:14), 1992, pp. 1111-1132.

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R. "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science* (35:8), 1989, pp. 982-1002.

De Vos, H., ter Hofte, H, de Poot, H. "IM [@Work] Adoption of Instant Messaging in a Knowledge Worker Organization," in *Proceedings of the Thirty-Seventh Annual Hawaii International Conference on System Sciences*, 2004, Big Island, Hawaii

Fishbein, M., and Ajzen, I. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA, 1975.

Gefen, D., and Straub, D. W. "Gender Differences in Perception and Adoption of E-Mail: An Extension to the Technology Acceptance Model," *MIS Quarterly* (21:4), 1997, pp. 389-400.

Gefen, D.; Straub, D. W.; and Boudreau, M. C. "Structural Equation Modeling and Regression: Guidelines for Research Practice," *Journal of the Association for Information Systems*, 4, 7 (2000).

Grinter, R.E., and Palen, L. "Instant Messaging in Teen Life," *In Proceedings of the 2002 ACM conference on Computer supported cooperative work*, 2002, pp. 21-

30.
Hair, J. F. Jr.; R. E. Anderson; R. L. Tatham; and W. C. Black. *Multivariate Data Analysis with Readings*, 5th ed. Englewood Cliffs, NJ: Prentice Hall, 1998. pp. 577-652.
Hong, W., Thong, Y. L. J., Wong, W., and Tam, K. "Determinants of User Acceptance of Digital Libraries: An Empirical Examination of Individual Differences and Systems Characteristics," *Journal of Management Information Systems* (18:3), Winter 2001/2002, pp. 97-124.
Huang, A. H., and Yen, D. C. "Usefulness of Instant Messaging among Young Users: Social vs. Work Perspective," *Human Systems Management* (22:2), 2003, pp. 63-72
ICQ.Com. *The ICQ Story* [Online], Available: http://company.icq.com/info/icqstory.html, [2004, March 23]
Igbaria, M., and Chakrabarti, A. "Computer Anxiety and Attitudes towards Microcomputer Use," *Behavior and Information Technology* (9:3), 1990, pp. 290-241
Igbaria, M., Guimaraes, T., and Gordon, G. B. "Testing the Determinants of Microcomputer Usage via a Structural Equation Model," *Journal of Management Information Systems (11:4),* 1995, pp. 87-114.
Igbaria, M., Zinatelli, N., Cragg, P., and Cavaye, A. L. M. "Personal Computing Acceptance Factors in Small Firms: A Structural Equation Model," *MIS Quarterly* (21:3), 1997, pp. 279-305.
Isaacs, E., Walendowski, A., Ranganathan, D. "Hubbub: A Sound-enhanced Mobile Instant Messenger that Supports Awareness and Opportunistic Interactions," in *CHI 2002 Conf. Proc*. (4:1), 2002a, pp. 179–186.
Isaacs, E., Walendowski, A., Ranganathan, D. "Mobile Instant Messaging Through Hubbub," *Communications of the ACM* (45:9), 2002b, pp. 68-72.
Isaacs, E., Walendowski, A., Whittaker, S., Schiano, J. D., and Kamm, C, "The Character, Functions, and Styles of Instant Messaging in the Workplace," In *Proceedings of the 2002 ACM conference on Computer supported cooperative work*, 2002c, pp. 11-20.
Legris, P., Ingham, J. and Collerette, P. "Why Do People Use Information Technology? A Critical Review of the Technology Acceptance Model," *Information and Management* (40), 2003, pp.191-204.
Lenhart, A., Rainie, L. and Lewis, O., *"Teenage Life Online: The Rise of the Instant-message Generation and the Internet's Impact on Friendships and Family Relationship*s", Pew Internet & American Life Project, Washington, D.C., USA, 2001. Retrieved from http://www.pewinternet.org/reports/toc.asp?Report=36
Lloyd-Richardson, E. E, Papandonatos, G., and Kazura, A. "Differentiating Stages of Smoking Intensity Among Adolescents: Stage-Specific Psychological and Social Influences," *Journal of Consulting and Clinical Psychology* (70:4), 2002, pp. 998-1009.
Limayem, M., Cheung, C. M. K., and Chan, G. W. W. "Explaining Information Systems Adoption and Post-Adoption: Toward an Integrative Model," In *Proceedings of the Twenty-Fourth International Conference on Information Systems,* 2003, pp. 720-731.
Liu, R. X. "The Moderating Effects of Internal and Perceived External Sanction Threats on the Relationship between Deviant Peer Associations and Criminal Offending," *Western Criminology Review* (4:3), 2003, pp.191-202.
Lucas, H. C. "Empirical Evidence for a Descriptive Model of Implementation," *MIS Quarterly* (2:2), 1978, pp. 27-41.
Mock, K. "The Use of Internet Tools to Supplement Communication in the Classroom," *The Journal of Computing in Small Colleges* (17:2), 2001, pp. 14-21.

Nardi, B.A., Whittaker, S., and Bradner, E. "Interaction and Outeraction: Instant Messaging in Action," *In Proceedings of the 2000 ACM conference on Computer supported cooperative work*, 2000, pp. 79 – 88.

Nunnally, J. C., and Bernstein, I. H. *Psychometric theory* (3rd ed.), 1994, New York: McGraw-Hill.

Renneker, J. and Godwin, L., "Theorizing the Unintended Consequences of Instant Messaging for Worker Productivity," Sprouts: Working Papers on Information Environments. Systems and Organizations (3), Summer, 2003, Retrieved from http://weatherhead.cwru.edu/sprouts/2003/030307.pdf

Rogers, E. M. *Diffusion of Innovation,* 4th ed., The Free Press, New York, 1995.

Santor, D. A., Messervey, D., and Kusumakar, V. "Measuring Peer Presure, Popularity and Conformity in Adolescent Boys and Girls: Predicting School Performance, Sexual Attitudes, and Substance Abuse," *Journal of Youth and Adolescence* (29:2), 2000, pp.163-182.

Saunders, C. *2003's Top Trends in IM* [Online], Available: http://itmanagement.earthweb.com/entdev/article.php/329408, [2003, Dec. 30]

Savin-Williams, R. C., and Berndt, T. J. "Friendship and Peer Relations," In S.S.R. Elliott (Eds.), *At the Threshold: the Developing Adolescent,* Cambridge, MA: Harvard University Press, 1990, pp. 277-307.

Sim, T. N., and Koh, S. F. "A Domain Conceptualization of Adolescent Susceptibility to Peer Pressure," *Journal of Research on Adolescence* (13:1), 2003, pp. 57-80.

Simons-Morton, B. "Prospective Association of Peer Influence, School Engagement, Drinking Expectancies, and Parent Expectations with Drinking Initiation Among Sixth Graders," *Addictive Behaviors* (29), 2004, pp.299-309.

Swartz, N. "Instant Messaging goes Corporate," *Information Management Journal* (37:4), Jul/Aug 2003, pg. 8.

Szajna, B. "Empirical Evaluation of the Revised Technology Acceptance Model," *Management Science* (42:1), 1996, pp.85-92.

Taylor, S., and Todd, P. A. "Understanding Information Technology Usage: A Test of Competing Models," *Information Systems Research* (6:2), 1995, pp. 144-176.

Venkatesh, V. "Creation of Favorable User Perceptions: Exploring the Role of Intrinsic Motivation," *MIS Quarterly* (23:2), 1999, pp. 239-260.

Venkatesh, V. "Determinants of PEOU: Integrating Control, Intrinsic Motivation, and Emotion into the Technology Acceptance Model," *Information Systems Research* (11:4), 2000, pp. 342-365.

Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. "User Acceptance of Information Technology: Toward a Unified view," *MIS Quarterly* (27:3), 2003, pp. 425-478.

Appendix A: Items used in this study

Performance expectancy

1. I would find this chat software useful for my study or work.
2. Using this chat software enables me to accomplish tasks more quickly.
3. Using this chat software increases my productivity.

Effort expectancy

1. My interaction with this chat software would be clear and understandable.
2. It would be easy for me to become skillful at using this chat software.
3. I would find this chat software easy to use.
4. Learning to use this chat software is easy for me.

Attitude toward using technology

1. Using this chat software is a good idea.
2. This chat software makes my life more interesting.
3. Working with this chat software is fun.

4. I like working with this chat software.

Social influence

1. People who influence my behavior think that I should use this chat software.
2. People who are important to me think that I should use this chat software.

Facilitating conditions

1. I have the resources necessary to use this chat software.
2. I have the knowledge necessary to use this chat software.
3. This chat software is compatible with other chat software I use.*

Self-efficacy

1. I can complete a task using this chat software if there is no one around to tell me what to do.
2. I can complete a task using this chat software if I could call someone for help.*
3. I can complete a task using this chat software if I have a lot of time.*
4. I can complete a task using this chat software with just the built-in help facility.

Anxiety

1. I feel apprehensive (worried) about using this chat software.
2. I hesitate to use this chat software for fear of making mistakes I cannot correct.*
3. This chat software is somewhat intimidating for me.

Behavioral intention

1. I intend to use this chat software in the next 3 months.
2. I predict I would use this chat software in the next 3 months.
3. I plan to use this chat software in the next 3 months.

Use Behavior

1. How often did you use the chat software during the last month?

Experience

1. How much experience do you have with the software?

Peer Influence

1. Many of my friends use this chat software.
2. I am close to most of the people in my chat software contact list.
3. I am familiar with many people in my chat software contact list.

Functional capability

1. I think being able to launch my buddy list from any computer using this software is important to me.
2. I think the function of sending offline messages (if available) in this software is important to me.
3. I think the function of allowing users to check emails when using this software is important to me.
4. I think being able to appear offline (invisible) using this chat software is important to me.
5. I like the way I'm notified when an offline contact jumps online when using this chat software. (pop-up window vs. knocking sound)
6. I think the history-keeping function of this chat software is important to me.
7. I think the frequency of update and release of newer versions of this chat software is important to me.
8. I think add-on services such as real-time video and audio chatting (if available) of this software is important to me.
9. I think the function of visible list (if available) in this software is important to me.
10. I like the user interface of this chat software.

***** *indicates that the item is removed due to low loadings*

Appendix B

	PE*	***EE***	***PEER***	***SI***	***FC***	***BI***	***SE***	***ANX***	***ATT***
Reliability	*****ρ_C=0.92***	***ρ_C=0.92***	***ρ_C=0.87***	***ρ_C=0.92***	***ρ_C=0.93***	***ρ_C=0.98***	***ρ_C=0.84***	***ρ_C=0.85***	***ρ_C=0.93***
PE1	**0.92**	0.42	0.45	0.35	0.23	0.46	0.26	0.17	0.54
PE2	**0.94**	0.37	0.44	0.38	0.20	0.42	0.25	0.06	0.55
PE3	**0.83**	0.26	0.31	0.29	0.11	0.25	0.15	0.03	0.40
EE1	0.37	**0.78**	0.36	0.14	0.36	0.44	0.29	0.27	0.44
EE2	0.33	**0.89**	0.41	0.21	0.49	0.43	0.47	0.36	0.46
EE3	0.37	**0.89**	0.46	0.22	0.45	0.49	0.43	0.31	0.51
EE4	0.34	**0.91**	0.45	0.23	0.52	0.51	0.48	0.35	0.52
PEER1	0.37	0.52	**0.85**	0.34	0.32	0.66	0.35	0.16	0.53
PEER2	0.44	0.43	**0.89**	0.42	0.21	0.68	0.33	0.13	0.64
PEER3	0.34	0.22	**0.75**	0.32	0.14	0.48	0.14	0.05	0.38
SI1	0.29	0.12	0.33	**0.90**	0.13	0.29	0.18	0.08	0.36
SI2	0.40	0.28	0.45	**0.95**	0.13	0.43	0.25	0.01	0.44

FC1	0.17	0.42	0.26	0.15	**0.90**	0.23	0.39	0.22	0.33
FC2	0.21	0.54	0.25	0.12	**0.96**	0.34	0.48	0.31	0.42
BI1	0.41	0.51	0.69	0.38	0.30	**0.97**	0.32	0.19	0.61
BI2	0.46	0.55	0.74	0.42	0.33	**0.98**	0.34	0.17	0.63
BI3	0.42	0.52	0.72	0.37	0.30	**0.98**	0.29	0.19	0.62
SE1	0.30	0.48	0.30	0.20	0.47	0.29	**0.86**	0.32	0.35
SE4	0.14	0.34	0.29	0.20	0.33	0.27	**0.84**	0.14	0.28
ANX1	0.11	0.32	0.12	0.04	0.16	0.16	0.15	**0.86**	0.18
ANX3	0.05	0.33	0.13	0.03	0.35	0.16	0.31	**0.86**	0.17
ATT1	0.52	0.57	0.53	0.41	0.35	0.54	0.35	0.18	**0.83**
ATT2	0.50	0.43	0.57	0.43	0.38	0.58	0.30	0.14	**0.91**
ATT3	0.42	0.47	0.53	0.33	0.39	0.49	0.30	0.18	**0.88**
ATT4	0.53	0.49	0.60	0.38	0.33	0.60	0.36	0.22	**0.90**

***Notes:**

PE=Performance Expectancy EE=Effort Expectancy PEER=Peer Influence
SI=Social Influence FC=Facilitating Condition BI=Behavioral Intention
SE=Self Efficacy ANX=Anxiety ATT=Attitude

Table B1. Loadings and Cross-Loadings for each Construct in the Measurement Model

**Composite Reliability = $\rho_C = (\Sigma\lambda_i)^2 / [(\Sigma\lambda_i)^2 + \Sigma_i var(\varepsilon_i)]$, where λ_i is the component loading to an indicator and $var(\varepsilon_i)=1 - \lambda_i^2$

	EE	*PE*	*BI*	*SI*	*FC*	*PEER*	*SE*	*ANX*	*ATT*
EE*	**0.75**								
PE	0.16	**0.80**							
BI	0.29	0.19	**0.95**						
SI	0.05	0.15	0.16	**0.86**					
FC	0.28	0.04	0.10	0.02	**0.87**				
PEER	0.24	0.21	0.55	0.19	0.08	**0.70**			
SE	0.24	0.07	0.11	0.06	0.22	0.12	**0.72**		
ANX	0.14	0.01	0.03	0.00	0.09	0.02	0.07	**0.74**	
ATT	0.31	0.32	0.40	0.19	0.17	0.40	0.14	0.04	**0.77**

***Notes:**

PE=Performance Expectancy EE=Effort Expectancy PEER=Peer Influence
SI=Social Influence FC=Facilitating Condition BI=Behavioral Intention
SE=Self Efficacy ANX=Anxiety ATT=Attitude

**The bold typeface numbers on the leading diagonal are the square roots of the variance shared between the constructs and their measures. Off diagonal elements are the correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Table B2. Correlation among Construct Scores (AVE Extracted in Diagonals)